School of Information Technology
IIT Kharagpur

Course Id: IT60101 Foundations of Computing Systems   **Class Test 1**
Date: August 10, 2006   **Total Time: 60 minutes**   **Max. Marks: 35**

Instructions: Answer all questions. You may answer the questions in any order. However, all parts of the same question must be answered together. Clearly state any reasonable assumption you make.

1. Write TRUE or FALSE (Each question carries 2 marks. One mark will be deducted for a wrong answer) **[2×3=6]**

   (a) Let T be a BST whose keys are distinct. Let **x** be a leaf node and let **y** be its parent. Then **key[y]** is either the smallest key in T larger than **key[x]** or the largest key in T smaller than **key[x]**.
   (b) If a node in a BST has two children, then its successor has no right child and its predecessor has no left child.
   (c) A sorted array of any number of elements represents a Min-heap.

2. **[5+5=10]**
   (a) Define a Binary Search Tree (BST).
   (b) Suppose we have numbers between 1 and 1000 in a BST and we want to search for the number 363. Which of the following sequences could NOT be the sequence of nodes examined?
       a. 2, 252, 401, 398, 330, 344, 397, 363
       b. 924, 220, 911, 244, 898, 258, 362, 363

3. Consider a binary tree with 10 nodes as shown below. You have to number the nodes 1-10 in such a way that post-order traversal of the tree will generate the numbers 1-10 sequentially. **[9]**
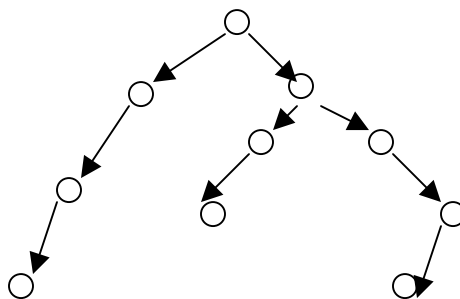
4. **[5+5=10]**
   (a) Consider an array implementation of a Stack S [1..N]. Write pseudo-codes for Push (S,x) and Pop (S) operations. You must detect overflow and underflow conditions.
   (b) Explain how to implement two stacks S1 and S2 in one array A[1..N] in such a way that neither stack overflows unless the total number of elements in both stacks together is N. You need to write pseudo codes for the Push and Pop operations (Whether to write functions separately for each stack or combined is your choice).